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(Bulletins 258 to 268 constitute the Report for 1917. In binding, pages i-xvi at the end of this bulletin should be detached and placed before Bulletin 258 which begins with page 1)

# Maine Agricultural Experiment Station

ORONO

BULLETIN 268

DECEMBER, 1917

ABSTRACTS OF PAPERS NOT INCLUDED IN  
BULLETINS, FINANCES, METEOR-  
OLOGY, INDEX.



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# MAINE AGRICULTURAL EXPERIMENT STATION ORONO, MAINE.

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\* Absent on leave during period of war.

† In collaboration with U. S. Department of Agriculture.

## BULLETIN 268

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### ABSTRACTS OF PAPERS PUBLISHED BY THE STATION IN 1917 BUT NOT INCLUDED IN THE BULLETINS.

A complete list of all the publications issued by and from the Station in 1917 is given on pages x to xii of the introduction to this Report. The following pages contain abstracts of the papers issued during the year that are not included in the Bulletins or Official Inspections for the year.

### THE EXPERIMENTAL MODIFICATION OF GERM CELLS.

#### I. GENERAL PLAN OF EXPERIMENTS WITH ETHYL ALCOHOL AND CERTAIN RELATED SUBSTANCES\*

This paper is the first of a series of studies having to do with attempts, in the first place, to modify hereditary factors or determinants in a definite and specific way, and in the second place, to observe and analyze the hereditary behavior following such modification. The results here reported followed attempts to modify the germ cells by treating the individual domestic fowl with one or another of three poisons, viz., ethyl alcohol, methyl alcohol and ether.

The males used were Black Hamburgs. The females were pure bred Barred Plymouth Rocks. Both strains used have been so long pedigree bred, and used in such a variety of Mendelian experiments, that they may be regarded as reagent strains, whose genetic behavior may be predicted with practically complete certainty. Analyses of the inbreeding in their parents indicate that the amount of intensity of this inbreeding is low.

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\*This is an abstract from a paper by Raymond Pearl, having the same title and published in the Journal of Experimental Zoology, Vol. 22, No. 1, pp. 125-164.

This foundation stock is shown to be a random sample of the general population from which it came.

F<sub>1</sub> offspring from these parents were treated with the above poisons. The advantages in the use of these crossbred were, first, a heterozygous condition of many factors enabling a test of the effects of the poisons on usual conditions of Mendelian dominance, second, a possible increase in vigor due to heterosis. Full brothers and sisters of the treated birds were used to control the experiments.

The poisons were administered daily by the inhalation method in practically as large doses as could be tolerated when given in this way. Large tanks containing 7 cubic feet of air with capacity for 4 to 5 birds and small tanks with 4 cubic feet were used. Cotton was placed in an inhalation compartment soaked with the reagent. The air is then saturated with an atomizer and the birds introduced into the chamber. By this method a treatment in saturated air for one hour daily is insured. No accurate measure of the amount of inhaled alcohol is available. An estimate of the amount may, however, be made from the amount consumed in one inhalation. These amounts are, for the large tank, 45 cc. and for the small, 30 cc. or an amount per bird corresponding to that of a steady but moderate drinker.

It is reasonable to suppose that the effect, if any, of the alcoholization of the parents upon the progeny will depend in some degree, at least, upon the period of time during which the parents have been subject to treatment with alcohol prior to the birth of the offspring. The measure of this pre-birth treatment may be designated as the "total germ dosage index" and defined as the total number of days during which the two gametes making the offspring zygote have been exposed to alcoholic influence while sojourning in the body of the treated individual. Express graphically.

TOTAL GERM DOSAGE INDEX IN DAYS =  $(M_b - A_{\text{♂}}) + (M_b - A_{\text{♀}})$ , where

M = Mean date of hatching of progeny.

A<sub>♂</sub> = Date when treatment of ♂ parent began.

A<sub>♀</sub> = Date when treatment of ♀ parent began.

The treatment of the  $F_1$  generation ranges from 130 to 354 days with a mean of 210.35 days, or approximately 7 months in these experiments.

## THE EXPERIMENTAL MODIFICATION OF THE GERM CELLS.

### II. THE EFFECT UPON THE DOMESTIC FOWL OF THE DAILY INHALATION OF ETHYL ALCOHOL AND CERTAIN RELATED SUBSTANCES.\*

This paper, the second of the series, deals with the effect of alcohol and related substances on the treated individuals. Summarily stated the results of this study are:

1. The mortality among the treated birds was much smaller than among their untreated control sisters. After 15 months of treatment the difference was 41 per cent in favor of the treated birds.

2. The body weight changes in the treated birds were as follows: immediately following the starting of treatment, which was in the autumn, there was an increase in mean body weight, probably in no way due to the treatment. Following this initial rise, which reached its peak in January or February, there was a sharp and prolonged fall in mean body weight which reached its lowest point in May or June. Beginning in June or July there was a steady increase in mean body weight continuing without break until the end of the period covered in this report (February 1, 1916). At the date mentioned the treated birds were on the average 9.9 per cent heavier than their untreated sisters.

3. Neither the total amount nor the distribution of egg production were significantly different in the treated birds from what they were in the controls. Both treated and control birds laid normally and well. Taking the whole untreated flock, the mean production per bird in the 15 months was 184.74 eggs, while the mean production for the treated birds was 183.97. Generalizing the results we may say that the treated birds are slightly superior to the untreated birds.

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\*This paper is an abstract from a paper by Raymond Pearl, having the same title and published in the *Journal of Experimental Zoology*, Vol. 22, No. 1, pp. 165-186.

## THE EXPERIMENTAL MODIFICATION OF GERM CELLS.

## III. THE EFFECT OF PARENTAL ALCOHOLISM AND CERTAIN OTHER DRUG INTOXICANTS UPON THE PROGENY.\*

This paper deals with the influence on the offspring of alcohol and like poisons administered to the parents. That this is one of the most fundamental problems of breeding admits of no doubt. The method by which this general problem is attacked in the present investigation is that of exposing systematically the germ cells of the bird to the fumes of ethyl alcohol, methyl alcohol and ether and analyzing the results on the offspring. The specific conclusions coming out of this investigation are:

1. The fertility of the eggs where one or both individuals are treated is reduced in direct proportion to the dosage of the poison.

2. The parental mortality (percentage of dead embryoes) was materially smaller where one or both parents were treated than the controls. The same conclusion holds true for post natal mortality.

3. The sex ratio of the progeny was not materially effected by treatment of the parents.

4. There was no significant difference in hatching weight of the offspring of treated males and the offspring of normal untreated control males when both were mated to sound untreated females. Both the male and female offspring of matings in which both parents were treated showed a higher mean hatching weight than the offspring of either completely normal control matings, or of matings in which the father only was treated. The adult offspring of alcholyzed parents (one or both) were heavier than the controls.

5. In the case of the male chickens there was no substantial difference in the rate of growth in the three lots until after an age of about 100 days was passed. From that point on the male offspring of treated ♂♂ X untreated and treated ♀♀ grew at a more rapid rate than the controls. The difference in mean

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\*This paper is an abstract from a paper by Raymond Pearl, having the same title and published in the Journal of Experimental Zoology, Vol. 22, No. 2, pp. 241-310.



body weight for a given age became increasingly large as the age advanced. In the case of the female chickens there was no substantial difference in the rate of growth in the three lots until after an age of 150 days was passed. During the next 25 days the controls grew faster than the chicks from treated parents. At and after 200 days of age, however, the offspring of treated parents (one and both) showed a higher mean body weight than the controls. At all ages in the case of the male chicks, and in all ages but two (12.5 and 19.5 days) in the case of the female chicks, the mean body weight of the offspring having both parents alcoholic was higher than that of the offspring having one parent only, the father, alcoholic.

6. The proportion of abnormal chicks produced from treated parents was no greater than that produced from untreated parents.

7. The normal Mendelian inheritance was in no way affected by the treatment of the parents, so far as concerns any of the numerous characters observed and tested. This statement applies only to phenomena of dominance, recessiveness and sex linkage. Other Mendelian phenomena have not as yet been tested in these experiments.

8. There was no evidence from these experiments that the treatment of individual fowls, whether male or female, with either ethyl alcohol, methyl alcohol, or ether, had any deleterious effect upon those germ cells which formed zygotes. The treatment rendered many germ cells incapable of forming zygotes at all, but those which did form zygotes had plainly not been injured in any way. Further no specific germinal changes have been induced by the treatment, at least so far as concerns those germ cells which produced zygotes.

It is suggested that these results, as well as the results of earlier workers, may be most satisfactorily accounted for on the hypothesis that alcohol and similar substance act as selective agents upon the germ cells of treated animals. The essential points in such an hypothesis may be put in the following way.

a. Assume that the relative vigor, or resisting power of germ cells varies or grades continuously from a low degree to a high degree and further assume that the absolute vigor of the whole population of germ cells, measured by the mean let us say, is different for different species.

b. In the intensity of dosage employed in inhalation experiments alcohol does not destroy or functionally inactivate all germ cells. The proportionate number of the whole population of germ cells which will be inactivated by such dosage may fairly be supposed to depend upon the mean absolute vigor or resisting power characteristic of the particular species or strain used. In a species with germ cells of absolutely low mean vigor proportionately more will be functionally inactivated than in a species of high absolute mean vigor of germ cells.

c. Besides the germ cells which are wholly inactivated by the deleterious agent, and which we may designate as class (a), we may fairly assume that there is a possibility of two other classes existing, viz., (b) germ cells which, while not completely inactivated, are so injured by the agent as to produce zygotes which are measurably defective in some degree, and (c) germ cells which are not measurably affected by the agent at all in the dosage employed, and produce zygotes which are not discernibly otherwise than perfectly normal.

d. It appears entirely fair to assume that germ cells of the (a) class are of relatively the lowest mean vigor or resisting power, class (b) next, and class (c) the highest. The proportionate number of the two sorts of zygotes corresponding to classes (b) and (c) of germ cells which would be expected to appear in any experiments made to test the point would clearly be a function of the mutual relationship or proportionality between two variables, the dosage of the deleterious agent on the one hand, and the mean absolute resisting power of the germ cells characteristic of the strain or species of animal used in the experiments on the other hand.

e. If the dosage of the agent be relatively high in proportion to the mean absolute resisting power it would be expected that all the germ cells would fall into classes (a) and (b), producing no zygotes at all or zygotes in some degree defective. This about represents the condition, so far as can be judged from the data given, with Stockard's alcoholized guinea pigs and Weller's lead-poisoned guinea pigs. The dosage is sufficiently high in proportion to the absolute germinal resisting power that all or practically all of the offspring are defective in greater or less degree and in reference to some one or more characters. Stockard's  $F_2$  and  $F_3$  results indicate that

though the untreated  $F_1$  animals from alcoholists may appear normal, they really are somewhat defective.

f. If, on the other hand, the dosage, though absolutely the same, be relatively lower in proportion to the mean absolute resisting power of the germ cells it would be expected that all three germ cell classes (a), (b) and (c) would be represented. The zygotes actually formed would be chiefly produced by (c) germ cells, and to a much smaller extent by (b) cells. Under these circumstances it would necessarily follow that a random sample of the zygotes produced after the action of the deleterious agent would, on the average, be superior in respect to such qualities as growth, etc., which may be supposed to depend in part at least upon germinal vigor, to a random sample of zygotes formed before the action of the agent, because the germ cells of class (c) are a selected superior portion of the total gametic population.

g. Essentially that proportionality between effective dosage of the deleterious agent and absolute resisting power of the germ cells outlined in the preceding paragraph (f) is believed to have obtained in the present experiments with fowls, Nice's experiments with mice, and nature's experiments with the workingmen's population studied statistically by Elderton and Pearson.

### THE PROBABLE ERROR OF A DIFFERENCE AND THE SELECTION PROBLEM.\*

This paper deals with the results of Ackert in selection of *Paramecium*. Due to his arithmetically wrong calculation of the probable error of a difference Ackert deductions based on this are wrong. Corrected his data is contradictory and when compared with the other selection work on *Paramecium* neither confirms nor refutes the previous results.

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\*This paper is an abstract from a paper by Raymond Pearl, having the same title and published in the *Genetics*, Vol. 2, pp. 78-81.

ON THE DIFFERENTIAL EFFECT OF CERTAIN CALCIUM SALTS  
UPON THE RATE OF GROWTH OF THE TWO SEXES OF THE  
DOMESTIC FOWL.\*

Calcium Lactate and Calcium lacto-phosphate given to chicks in doses of 0.1 gram to 0.3 grams daily are shown to increase the body weight and reproductive ability of the females but in no way to effect the males. An inhibitory substance, corpus lutum, also inhibits this increase as the presence of the calcium salts.

A NOTE ON FITTING OF PARABOLAS.†

Formula for the fitting of parabolas by the method of Moments assuming origin at the mid-point have already been given by Pearson. A need has, however, been felt by many investigators for formulas and tables for fitting of parabolas taking origin one unit below the first ordinate. This paper supplies such a need.

THE PROBABLE ERROR OF A MENDELIAN CLASS  
FREQUENCY.‡

In view of the defect in the calculation of the probable errors of small subclasses in mendelian work, the writer has suggested a new method of estimating the significance of these constants by calculating the median and quartile classes. Tested on material where the hypergeometrical is known, this method gives good results.

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\*This paper is an abstract from a paper by Raymond Pearl, having the same title and published in Science, N. S., Vol. XLIV No. 1141, pp. 687-688.

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†This paper is an abstract from a paper by John Rice Miner, having the same title and published in The Proceedings of the National Academy of Sciences, Vol. 3, pp. 91-95.

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‡This paper is an abstract from a paper by Raymond Pearl, having the same title and published in the American Naturalist, Vol. LI. No. 603, pp. 144-156.

## THE SELECTION PROBLEM.\*

This paper deals with the general problem, "Does selection (in the sense of long continued selection) cause gradual changes in the given plasm in the direction of selection." The evidence when studied is found to prove just the opposite, that these supposed careful selections are in reality chance selection of favorable mutations.

STUDIES ON THE PHYSIOLOGY OF REPRODUCTION  
IN THE DOMESTIC FOWL.XVII. THE INFLUENCE OF AGE UPON REPRODUCTION ABILITY,  
WITH A DESCRIPTION OF A NEW REPRODUCTIVE INDEX.†

The belief is widespread among poultry breeders that two year-old birds or older should be used for breeding purposes. The alleged reasons for this are superior vigor of the offspring or more numerous progeny per mating, etc. This paper takes up the points for the 1114 mating in the nine years' experience of the writer. A mathematical measure of the reproductive ability or fertility is introduced for this treatment. This New Reproductive Index for Poultry is

$$\text{RI} = \frac{\text{Number of chickens alive at the end of the 3rd week after hatching} \times 100}{\text{Total number of days from the day when this mating began to the day when the last egg from this mating began its incubation.}}$$

Treated in this way the following facts are brought out:

For the strain of Barred Rocks used, and under the conditions of environment and management which obtained during the experiments, the reproductive index has a mean value of about 12 per cent.

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\*This paper is an abstract from a paper by Raymond Pearl, having the same title and published in the American Naturalist, Vol. LI, No. 602, pp. 65-91.

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†This paper is an abstract from a paper by Raymond Pearl, having the same title and published in Genetics, Vol. 2, pp. 417-432.

Net fertility, as measured by the reproductive index, is a rather highly variable character, agreeing in this respect with other purely physiological characters.

Reproductive ability, as measured by the index, diminishes with advancing age of the birds mated, having its maximum when each of the birds mated is from 10 to 14 months of age.

The decline in reproductive ability with advancing age is at a more rapid rate in the case of the males than in the case of the females.

## STUDIES ON OAT BREEDING V.

### THE $F_1$ AND $F_2$ GENERATIONS OF A CROSS BETWEEN A NAKED AND A HULLED OAT.\*

This paper is an account of the results obtained from a cross between representatives of two subspecies *Avena sativa patula* var. Victor and *Avena sativa nuda* var. *incrmis*. The contrasting characters involved in this cross are: firm flowering glumes, biflorous spikelets, black color of the glumes, strong awns, a long but sparse pubescence at the sides of the base of the lower grain—vs. loose membranous flowering glumes, multiflorous spikelets, white or light yellow glume color, and almost total absence of awns and the absence of pubescence.

The  $F_1$  generation is distinctly intermediate in most characters. In regard to the glumes, both naked and firmly hulled grain as well as intermediate forms are found on the same panicle and even in the same spikelet.

The  $F_2$  generation segregates into a large number of intermediate forms. In addition to the two parental hull types, four intermediate classes were distinguished. These intermediate forms contain all gradations from the plants with perfectly hulled grain to the perfectly naked forms.

The inheritance of the hull characters presents a simple Mendelian relation giving 1 hulled, 2 intermediate, 1 naked. Likewise, in respect to grain color, there are 3 plants with black grain to 1 plant with white grain, the genes for these two characters, segregating independently of each other.

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\*This is an abstract from a paper by Jacob Zinn and Frank M. Surface, having the same title and published in the Journal of Agricultural Research Vol X, pp. 293-312.



Multiflorous spikelets occur only in connection with naked grain. Plants with completely hulled grain bear only biflorous spikelets.

The inheritance of the pubescence at the base of the lower grain presents some difficulties, since this character can not manifest itself on plants with naked grains. In the group of plants having hulled and intermediately hulled grains the pubescence behaves as a bifactorial character, giving 15 pubescent plants to 1 without pubescence. Neither of these genes are linked with the color genes.

The long and short pubescence at the base of the grain behaves as a monohybrid character and segregates independently of the other genes considered.

An interesting feature of this cross is the presence of pubescence at the base of the upper or second grain. No cultivated oat varieties possess this character. In this cross these forms occur only on spikelets where the lower grain is naked or seminaked, indicating that this condition may be due to physiological disturbances caused by the presence of the naked lower grain.

In regard to the inheritance of the awn character, the hulled and intermediately hulled types of grain appear to present a simple 3 to 1 ratio between plants with medium strong to strong awns and those plants with weak awns.

## STUDIES ON INBREEDING. VII.

### SOME FURTHER CONSIDERATION REGARDING THE MEASUREMENT AND NUMERICAL EXPRESSION OF DEGREES OF KINSHIP.\*

This paper has as its object the defining in simple manner the basic concepts of inbreeding. On the basis of these definitions a new and more accurate method of measuring and expressing numerically the degree of kinship between any two individuals, whatsoever, whose pedigrees are known, is possible. This new constant, the partial inbreeding index, is defined as the part of the total inbreeding exhibited in the pedigree of any individual which is due to relationship between the sire and the dam of that individual.

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\*This paper is an abstract from a paper by Raymond Pearl, having the same title and published in *The American Naturalist*, Vol. LI, No. 609, pp. 545-549.

## SEX STUDIES. IX.

## INTERSTITIAL CELLS IN THE REPRODUCTIVE\* ORGANS OF THE CHICKEN.\*

True, secreting, interstitial cells appear to be always present in the ovary. These cells are strictly homologous, and indeed cytologically identical in the fowl and in the cow. Furthermore these cells are cytologically identical in the male, when they are present, and in the female.

In the fowl true interstitial cells are sometimes present in the testis at the time of hatching. We have found no trace of them in the testes of a large series of adult males.

In general, the facts as to the occurrence and distribution of interstitial cells are such in the fowl as to make it very difficult to suppose that these cells have any casual influence upon secondary sexual characters.

## STUDIES ON INBREEDING. VIII.

## A SINGLE NUMERICAL MEASURE OF THE TOTAL AMOUNT OF INBREEDING.†

The need has been felt for a single numerical measure of inbreeding to supplement or replace the inbreeding curves. Such a constant has been found, which, it is believed, uniquely and rigorously meets the requirements. This new constant is defined by

$$\frac{Z_{Tn}}{100} = \frac{\sum \frac{Z_n}{Z_1}}{F_{Tn}}$$

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\*This paper is an abstract from a paper by Alice M. Boring and Raymond Pearl, having the same title and published in the *Anatomical Record*, Vol. 13, No. 5, pp. 253-268.

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†This paper is an abstract from a paper by Raymond Pearl, having the same title and published in *The American Naturalist*, Vol. LI, No. 610, pp. 636-639.



where  $\Sigma$  denotes summation of all values between the inclusive limits indicated, and  $F_{Tn}$  is a constant having the value set forth in Table 1.  $F_{Tn}$  is of course the total area of the maximum brother X sister curve up to and including the  $n+1$ -th generation. Studied by this unique measure the American Jersey Cattle are shown to be about 28 to 30 per cent as closely inbred as the maximum possible inbreeding which could occur.

### THE SEX RATIO IN THE DOMESTIC FOWL.\*

The material dealt with is the sex ratio found in over 22,000 chicks representing the matings of eight years' work by the writer. Data is presented to show that the normal sex ratio found in chickens indicate an excess of females. This excess of females is not a sporadic, but rather a regular phenomenon in the stock and conditions. The ratio in individual families is shown to be approximately symmetrical about the mean with high contact at both ends. These fitted curves make possible some definite conclusions, thus out of every 1000 families of twenty birds one is expected containing twenty or more pullets.

This difference in males to females is not due to prenatal mortality at least after the 10 days since of the dead embryos opened 927 were males and 994 females. The conclusion is justified that prenatal mortality is not differential in respect to sex, and that in consequence the observed sex ratio at birth is substantially the same as the initial zygotic sex ratio.

### AN INFESTATION OF POTATOES BY A MIDGE.†

On October 25, 1913, potatoes were received from Roxie, Maine, with the statement that they represented the condition of an infested acre. The trails contained numerous dipterous larvae so different from any pest known to the writer that it

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\*This paper is an abstract from a paper by Raymond Pearl, having the same title and published in the Proceedings of the American Philosophical Society, Vol. XVI, No. 5, 416-436.

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†This is an abstract of a paper with the same title, by Edith M. Patch, published in the Journal of Economic Entomology, Vol. 10, No. 5, 1917.

was at first suspected that they had worked into mines made by something else and that their presence was accidental. That such was not the case was testified by the larvae themselves when a cut tuber was placed under the microscope. The exposed miners were busily tunneling down into healthy tissue. As they worked they moved the ventral flap under the head up against the mouthparts. Some of the trails lay under the skin near the surface of the potato and were apparent as soon as the tuber was washed. Others extended for some distance into the vegetable.

The larvae were three-sixteenths of an inch in length. They were abundant in the trails, where frequently as many as fifteen or twenty could be found together in the wider places, though the narrow mines seemed to be the work of single individuals.

A specific determination was not possible on the data presented, but Dr. O. A. Johannsen kindly examined the larvae and pronounced them "probably *Camptocladus* sp."

No similar occurrence has come to the attention of the writer since this record for 1913 and it is hoped that the attack was due to some peculiar local condition which may not again prove favorable to this midge in its career as a serious pest of potatoes.

## EASTERN APHIDS, NEW OR LITTLE KNOWN, PART I.\*

The present paper resulted from the examination of the collection of Connecticut aphids lent by Dr. W. E. Britton. Several undescribed species were found, some of which were well known in certain collections without having made their way into literature. A few of these are briefly described by the writer of Part I, and the others are presented by Mr. Baker in Part II as he was already at work on the groups those species represent, and kindly undertook their examination.

Most of the species are described with reference to material from Connecticut, though a few not yet reported from that state are included.

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\*This is an abstract of a paper with the same title, by Edith M. Patch, published in *Journal of Economic Entomology*, Vol. 10, pp. 416-420.

The species treated were

APHIS VIBURNIPHILA n. sp.  
APHIS RUMEXICOLENS n. sp.  
APHIS SALICETI Kaltenbach  
APHIS DAVISI, new name  
PROCIPHILUS APPROXIMATUS n. sp.  
PROCIPHILUS XYLOSTEI de Geer  
LACHINUS ROSAE Cholodkovsky

## STUDIES UPON THE BLACKLEG DISEASE OF THE POTATO, WITH SPECIAL REFERENCE TO THE RELATIONSHIP OF THE CAUSAL ORGANISMS.\*

This paper may be roughly divided into two parts. The first part gives a brief historical review of the subject, describes the character and appearance of the disease, its geographical distribution and economic aspects, sources of infection, means of distribution, and control measures. The second part, is concerned with an investigation of the causal organisms, and contains the results secured from a comparative study extending over a series of years.

While the fact that the potato is subject to maladies like that under consideration was noted at a comparatively early date in the history of bacterial diseases of plants it was not until about 1897 that blackleg was definitely connected with a bacterial parasite. Since 1902 a number of different investigators in Europe and one in America have isolated, described and named as separate species, bacterial parasites associated with and found capable of causing the type of potato disease known as blackleg.

Blackleg is a disease of both the stem and tuber. The attacked stems are characterized by an inky-black discoloration starting from the base, at the junction with the seed piece. Usually the blackening extends only to the surface or at the most only a few inches above the surface of the soil. Under favorable weather conditions it may follow up the stem for several inches, or even out on the larger branches destroying

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\*This is an abstract of a paper by W. J. Morse, having the same title and published in the Journal of Agricultural Research, Vol. VIII, No. 3, pp. 79-126. January 15, 1917.

the stem with great rapidity. The attacked plants usually present a characteristic appearance in the field. If the progress of the disease is slow they are more or less unthrifty and undersized, and have a more compact, upward growing habit than normal, turning first lighter green then yellow and finally dying. If the progress of the disease is rapid the plant may fall over suddenly without much previous signs of disease.

A soft rot of the tubers is also produced. Infection takes place in the hill by means of the disease following along the stolons from the stem to the base of the tuber.

Blackleg has been observed in Germany, France, Belgium, Holland, England, Ireland, Canada and the United States. It was first reported in the United States in 1906 and in Maine in 1907. Evidence is given to show that it was introduced into and widely disseminated in the United States by means of infected seed potatoes.

Most writers on the subject have emphasized the economic importance of the disease. While blackleg is by no means unimportant, judgments based on observations made in Maine would indicate that its destructiveness has been overestimated. This more particularly applies to the losses occasioned by tuber decay caused by the blackleg organism, which have undoubtedly been confused with those primarily due to other causes.

At the same time the evidence is conclusive that in Maine the disease does not live over winter in the soil and that infected seed tubers are the sole source of infection and means of distribution of blackleg.

Successful methods of control have been worked out, which depend upon the elimination of all diseased or imperfect seed tubers and then disinfecting the remainder with corrosive sublimate or formaldehyde.

The aim of the bacteriological investigation was to secure cultures of all named pathogenic organisms previously described in Europe and America as the cause of blackleg and, in comparison with like cultures obtained from diseased plants in Maine, subject them to the same tests, at the same time, under identical conditions. This work resulted in the conclusion that *Bacillus atrosepticus* van Hall, *Bacillus solanisaprus* Harrison and *Bacillus melanogenes* Pethybridge and Murphy were identical with each other and with the organisms obtained from diseased plants

from different parts of Maine. For various reasons it was felt that the name *B. atrosepticus* should be adopted for the group. Two different cultures were obtained from Germany as *Bacillus phytophthorus* Appel but neither of these proved pathogenic. In cultural characters they did not agree with each other nor with Appel's original description of this organism.

### A FORM OF POTATO DISEASE PRODUCED BY RHIZOCTONIA.\*

What appeared to be an undescribed type of potato tuber disease was observed a few years ago in southern Maine for the first time. While authors have described many troubles more or less in association with Rhizoctonia, as far as the writer was able to ascertain, outside of Maine, no other reference had been made in the literature to this type of injury which the writer chooses to call "dry core" of the potato tuber.

Two phases of the disease are noted. First a stage which on superficial examination might be mistaken for common scab. Second, a stage showing a canal formation which might be confused with the injury caused by the wire worm.

In the first phase the fungus enters at the lenticels and works its way down into the tuber without much external disturbance. The definite boundary and dark brown color of the area suggests a form of scab. The interior mass of hyphae, broken-down cells and starch grains all remain in position, forming a dry core.

The second phase in this type of injury is found in the older stage where the infected area reaches a greater diameter than 3 mm. Owing to a drying out and shrinkage of tissues, a pit or canal is formed in the center of the affected area. This may present an appearance somewhat similar to wire worm injury.

The diseased areas are approximately circular in outline and at the surface vary in size from that of a lenticel to 6 or 7 mm. in diameter. They usually extend into the flesh of the tuber to a depth equal to or somewhat greater than the diameter.

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\*This is an abstract of a paper with the same title, by G. B. Ramsey, published in the Journal of Agricultural Research, Vol. IX, No. 12, June 18, 1917, pp. 421-426 with 4 plates.

The dry core thus formed is usually proportioned and shaped quite like a thimble. Surrounding the mature core there is a very definite line of demarcation separating the diseased tissue from the healthy. In many cases, by inserting the point of a knife, one may lift out these cores bodily.

*Rhizoctonia mycelium* is found in abundance in all stages of dry core formation. Pure cultures have repeatedly been obtained from the inner parts of the diseased areas. Evidence shows that the host cells die and loose their contents, and the walls suberize and are more or less broken down several cells in advance of the fungal filaments. This might lead one to suspect that part of the action is due to a toxin that is secreted by the fungus.

## METEOROLOGICAL OBSERVATIONS.

For many years the meteorological apparatus was located in the Experiment Station building and the observations were made by members of the Station Staff. June 1, 1911, the meteorological apparatus was removed to Wingate Hall and the observations are in charge of Mr. James S. Stevens, professor of physics in the University of Maine.

In September, 1914 the meteorological apparatus was again moved to Aubert Hall, the present headquarters of the physics department.

The instruments used were at Lat.  $44^{\circ} 54' 2''$  N. Lon.  $64^{\circ} 40' 5''$  W. Elevation 135 feet.

The instruments used are the same as those used in preceding years, and include: Maximum and minimum thermometers; rain gauge; self-recording anemometer; vane; and barometers. The observations at Orono now form an almost unbroken record of forty-nine years.



METEOROLOGICAL SUMMARY FOR 1917.  
*Observations Made at the University of Maine.*

1917.	January.	February.	March.	April.	May.	June.	July.	August.	September.	October.	November.	December.	Averages.	Totals.
Highest temperature.....	48	45	65	63	72	84	91	90	81	68	58	41	---	---
Lowest temperature.....	-10	-20	9	14	27	42	49	47	29	26	-1	-29	---	---
Mean temperature.....	20.2	17.3	30.2	41.6	48	61.5	70.0	68.9	53.0	46.4	33.4	15.6	42.17	---
Mean temperature in 49 years.....	16.57	12.5	30.0	40.2	51.5	60.8	65.9	66.1	59.8	50.8	38.1	24.2	42.75	---
Total precipitation in inches.....	4.11	3.67	3.22	2.39	3.18	7.49	4.05	4.09	1.08	5.89	1.65	3.24	---	44.06
Mean precipitation in 49 years.....	2.52	3.49	4.05	2.95	3.57	3.50	3.43	2.33	3.41	3.83	3.47	3.55	---	---
Number of days with precipitation of .01 or more.....	10	9	10	9	11	16	11	13	5	15	5	6	---	120
Snowfall in inches.....	24	31.5	13.0	12.0	3.0	---	---	---	---	3.0	2.75	28	---	117.25
Mean snowfall in 49 years.....	21.53	21.51	15.13	5.91	.23	---	---	---	---	.74	7.02	16.6	---	---
Number of clear days.....	15	17	20	16	12	16	24	21	24	17	17	17	---	216
Number of fair days.....	7	2	6	6	13	5	4	4	2	6	6	5	---	66
Number of cloudy days.....	9	9	5	8	6	9	3	6	4	8	7	9	---	83
Total movement of wind in miles.....	5213	3664	5066	4537	5319	3629	3449	3438	2789	5120	4183	4507	4285	51414



## REPORT OF THE TREASURER.

The Station is a department of the University and its accounts are kept in the office of the Treasurer of the University. The books, voucher files, etc., are, however, all distinct from those of the other departments of the University. The classification of accounts is that prescribed by the auditors on the part of the Federal Government, and approved by the State Auditor. All of the accounts are audited by the State Auditor, and the Hatch Fund and Adams Fund accounts are also audited by the Office of Experiment Stations acting for the United States Secretary of Agriculture in accordance with Federal Law.

The income of the Station from public sources for the year that ended June 30, 1917, was:

U. S. Government, Hatch Fund appropriation.....	\$15,000 00
U. S. Government, Adams Fund appropriation.....	15,000 00
State of Maine, Animal Husbandry investigation appropriation .....	5,000 00
State of Maine, Aroostook Farm investigation.....	5,000 00

The cost of maintaining the laboratories for the inspection analyses is borne by analysis fees and by the State Department of Agriculture. The income from sales at the experiment farms is used for the expense of investigations. The printing is paid for by an appropriation to the University.

REPORT OF TREASURER FOR FISCAL YEAR ENDING JUNE 30, 1917.  
DISBURSEMENTS.

RECEIPTS.	Hatch fund.	Adams fund.	Animal husbandry investigations.
Salaries -----	5919.07	11364.40	4827.12
Labor -----	3043.85	44.65	27.00
Publications -----	156.30	-----	-----
Postage and Stationery -----	759.69	116.24	46.25
Freight and Express -----	156.53	118.51	2.63
Heat, light and power -----	630.20	108.53	-----
Chemical and laboratory supplies -----	1.65	26.43	-----
Seeds, plants and sundry supplies -----	573.83	260.02	10.70
Fertilizers -----	191.10	-----	-----
Feeding stuffs -----	1946.45	1496.77	-----
Library -----	250.22	-----	-----
Tools, machinery and appliances -----	268.92	21.55	-----
Furniture and fixtures -----	80.29	142.81	-----
Scientific apparatus and specimens -----	74.42	136.30	-----
Live stock -----	-----	2.60	-----
Traveling expenses -----	515.57	440.65	26.30
Contingent expenses -----	40.00	180.00	-----
Buildings -----	391.91	540.54	-----
Total -----	15000.00	15000.00	4940.00

# REPORT OF TREASURER FOR FISCAL YEAR ENDING JUNE 30, 1917

## —Concluded.

## DISBURSEMENTS.

RECEIPTS.	Aroostook farm.	General account.	Inspection analysis.
Salaries .....	2470.69	3156.06	11139.08
Labor .....	4469.85	1733.80	-----
Publications .....	-----	-----	-----
Postage and Stationery.....	41.87	28.70	273.40
Freight and Express.....	60.30	57.78	163.21
Heat, light and power.....	85.41	89.08	432.87
Chemical and laboratory supplies.....	-----	6.14	544.38
Seeds, plants and sundry supplies.....	759.18	934.33	35.94
Fertilizers .....	753.92	11.93	-----
Feeding stuffs.....	544.09	145.94	-----
Library .....	-----	-----	-----
Tools, implements and machinery.....	339.00	14.77	-----
Furniture and fixtures.....	53.00	37.79	34.67
Scientific apparatus.....	-----	4.64	12.83
Live stock.....	986.00	1073.00	-----
Traveling expenses.....	121.86	330.88	101.06
Contingent expenses.....	126.57	301.33	17.70
Buildings .....	230.50	45.34	-----
Total.....	11042.24	7971.51	12755.14



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